Chapter 4 Army Single Channel SATCOM Architecture

Contents

The Army uses single channel satellite communications to provide long-haul, worldwide communications coverage supporting mobile tactical forces.

OVERVIEW

This chapter discusses the space and terminal segments of the current Army single channel Satellite Communications (SATCOM) architecture. This architecture supports tactical battlefield voice and data range extension requirements as well as deployment scenarios. Because of the unique missions of the Army Special Forces community, their SATCOM architecture will be separately addressed in Chapter 8.

Single channel systems are user-owned and operated and are considered part of Combat Net Radio (CNR) whether used alone or interfaced with terrestrial systems such as Single Channel Ground Air Radio System (SINCGARS) or Improved High Frequency Radio. Single channel terminals are vehicle mounted, manportable, or manpackable.

ARMY CONCEPT FOR USE OF SINGLE CHANNEL SATCOM

The Army uses single channel satellite communications to provide long-haul, worldwide communications coverage supporting mobile tactical forces. Single channel SATCOM is particularly important during contingency operations, crises, and training missions. Currently, the Army single channel SATCOM mission is supported by communications using the Ultra High Frequency (UHF) frequency band. With the impending fielding of the AN/PSC-11 Single Channel Anti-jam ManPortable (SCAMP) Milstar ground terminal, this mission will also be accomplished using the Extremely High Frequency (EHF) band. There are advantages and limitations to each and both are needed to support the Army's single channel SATCOM mission.

UHF has the advantage of low cost, user terminals that are small and lightweight and can operate well with small, packable antennas. It can be used on-the-move under adverse weather conditions and in dense foliage. On the other hand, UHF yields low data rates and is easily susceptible to both detection and jamming. EHF is a much less crowded part of the spectrum and affords an anti-jam, and Low Probability of Interception/Low Probability of Detection capability that is critical for the warfighter.

The single channel SATCOM mission, as shown in figure 4-1, provides worldwide tactical communications such as enroute contingency communications, in-theater communications, intelligence broadcast, and CNR range extension. Single channel SATCOM radios link tactical operations centers to all echelons and includes the Long Range Surveillance Units and Army Special Operations Forces units. These units can be separated hundreds of miles away from the main forces.

For many Army missions, the use of small portable SATCOM terminals for long haul communications is extremely beneficial to a warfighter already overloaded with a variety of life support gear. Even today, plans are underway for the Army to acquire a number of small, handheld receivers that will take advantage of currently deployed space systems and leverage extensively off of commercial technology. In the future, the Army, together with other services, will continue to seek out and critically define requirements that will lead to specific designs of space systems. To gain the advantages for the future, appropriate actions must be undertaken by the Army now to ensure that the desired outcomes are reached.

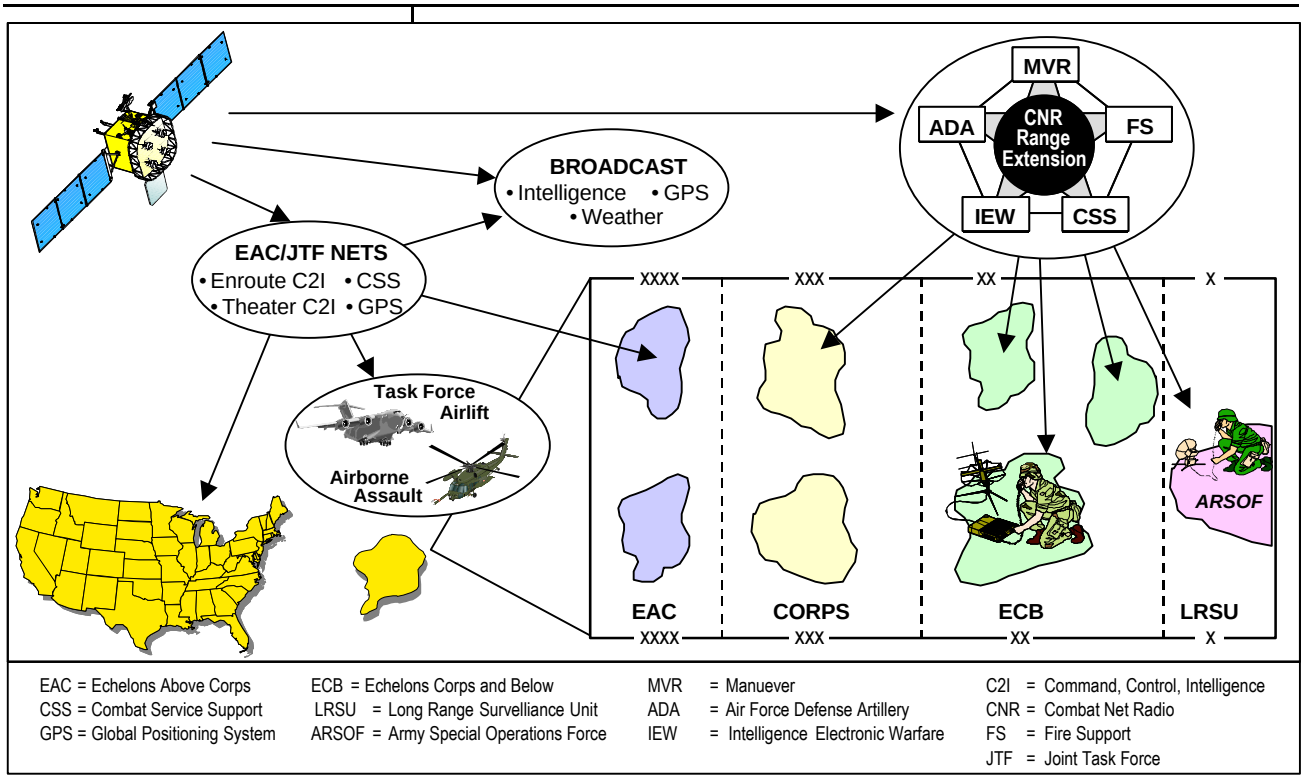


Figure 4-1. The Army Single Channel Mission Provides Worldwide Tactical Connectivity

SPACE SEGMENT FOR SINGLE CHANNEL SATCOM

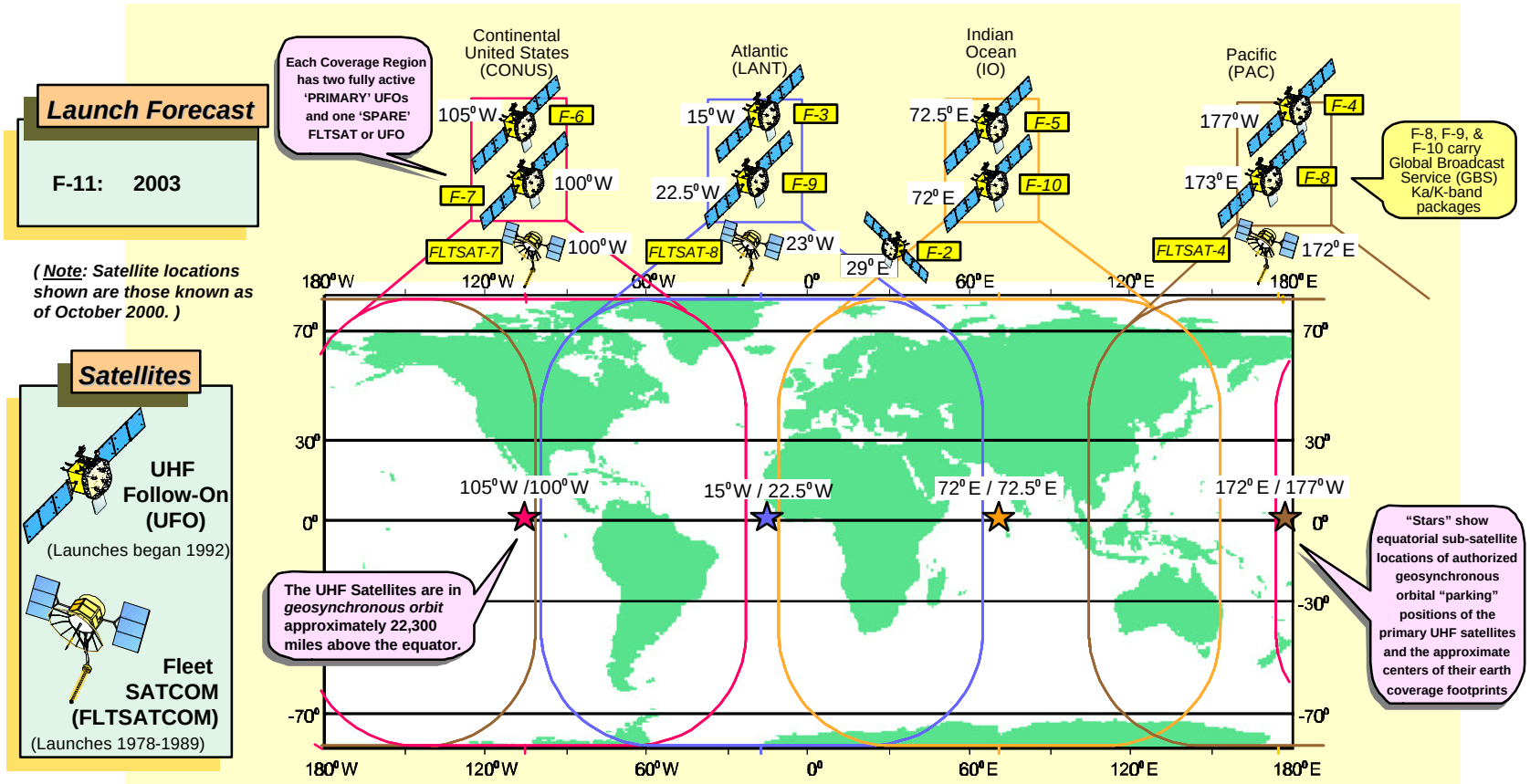
The Army single channel SATCOM mission is supported by communications transponders on a variety of space platforms.

Generally, the single channel SATCOM space segment receives and transmits radio frequency signals in the UHF spectrum between 225 MHz and 400 MHz. For Milstar single channel use, however, the EHF spectrum in 43-45 GHz is employed to uplink to the satellites. A specific frequency plan for each satellite controls which part of the spectrum the satellite uses. Such plans reduce interference between adjacent satellites and permit the same frequencies to be used by widely separated satellites.

The Army single channel SATCOM mission is supported by communications transponders on a variety of space platforms. The primary constellation that supports tactical mobile forces with single channel SATCOM transponders is the UHF Follow-On (UFO) system. Another Department of Defense (DoD) constellation, which is nearing the end of its design life, is the Fleet Satellite (FLTSAT) Communications System. The military UHF satellite constellation and coverage areas are shown at figure 4-2.

Additionally, there are other UHF payloads hosted aboard other satellites that provide UHF connectivity into the Polar Regions. The need for more capacity has prompted DoD to launch UHF communications "packages" on satellite vehicles designed for other missions. DoD UHF packages are carried on an amazing assortment of spacecraft, ranging from dedicated satellites to classified satellites and "space junk." There are even UHF transponders placed on unmanned aerial vehicles that can provide additional communications capacity. It is important to distinguish between a communications package,

Figure 4-2 Military UHF Satellite Constellation and Coverage Areas



Military UHF* Satellite Capabilities

UFO Satellites

- Transponders:
  - *All UFO Satellites:*
    - 17 Channels: UHF at 25 kHz BW
    - 21 Channels: UHF at 5 kHz
    - 1 Channel: Fleet Broadcast,SHF uplink/UHF downlink, 25 kHz BW*
  - *F-4, F-5, & F-6:*
    - 11 Channels: EHF* LDR*
  - *F-7, F-8, F-9, F-10, & F-11:*
    - 20 Channels: EHF LDR
  - *F-8, F-9, & F-10:*
    - 4 Transponders, 30 GHz uplink/20 GHz downlink, each supporting up to 24 Mbps for Global Broadcast Service
- Antennas:
  - UHF: 1 Earth Coverage Transmit & 1 Patch Receive Antenna
  - SHF: 1 Earth Coverage Transmit & 1 Earth Coverage Receive
  - EHF:
    - 1 Earth Coverage Receive
    - 1 Earth Coverage Transmit
    - 1 Five-degree Spot Beam Transmit Antenna
  - GBS:
    - 1 Fixed Patch Array Receive
    - 1 Steerable Patch Array Receive
    - 1 Broad (2000 nmi) Spot Beam Transmit
    - 1 Spot Beam (500 nmi) Transmit
- Transmitters:
  - UHF: 11 Transmit Power Amplifiers
  - SHF: 1 Transmitter
  - EHF: 4 Transmitters at 130 Watts

FLTSATCOM Satellites

- Transponders:
  - 1 Channel: Fleet Broadcast SHF uplink/UHF downlink at 25 kHz BW*
  - 9 Channels: UHF at 25 kHz BW
  - 12 Channels: UHF at 5 kHz BW
  - 1 Channel: UHF at 500 kHz BW
  - *(divided into twenty-one 25-kHz channels allocated to CINCs)*
- Antennas:
  - UHF:
    - 1 Earth Coverage Parabolic
    - 1 Earth Coverage Helix
  - SHF: 1 Earth Coverage Horn
  - EHF:
    - 1 Earth Coverage Receive
    - 1 Earth Coverage Transmit
    - 1 Five-degree Spot Beam Transmit Antenna
- Transmitters:
  - UHF: 12 Power Amplifiers at 25-43 Watts
  - SHF: 1 Transmitter
  - EHF:
    - 2 Transmitters at 20 Watts

*BW = Bandwidth
*LDR = Low Data Rate (75 bps - 2.4 kbps)
*nmi = Nautical Miles

*UHF = Ultra High Frequency; U.S. Military UHF satellites operate in the Military UHF-Band on 225 - 400 MHz.

*SHF = Super High Frequency; DSCS satellites operate in the SHF X-Band on 7.25 - 8.4 GHz.

*EHF = Extra High Frequency; U.S. Military EHF satellites uplink in the V-Band on 43-45 GHz & downlink in the K-Band on 20.2-21.2 GHz.

or payload, and the satellite vehicle. In the UHF satellite constellation several packages may coexist on the same satellite vehicle. Other single channel satellite communications capabilities exist that have classified missions. Those will not be discussed in this chapter.

The Milstar constellation is also in the process of being placed in orbit and will be another source of single channel SATCOM available for the warfighter. There are currently two satellites deployed and operational. After the failure of the third Milstar launch in April 1999, the debate continues on whether that particular satellite will be replaced. The Milstar constellation may be completed with only five satellites rather than the originally planned six.

The UHF Follow-On Satellite System

In 1992, the Navy began deploying a new UHF satellite constellation, the UFO (figure 4-3). It was designed to replace the existing FLTSATs as they wear out. The mission of the UFO system is to provide UHF links between tactical ground forces, naval aircraft, ships, submarines and their ground stations, and between strategic air headquarters and the National Command Authority network. The UFO system will support over 10,000 manpack, ship, airborne, mobile, and fixed ground UHF terminals.

Figure 4-3. UHF Follow On Satellite

Control of the UFO spacecraft was transferred from the Air Force to the Navy in June 1999. The Naval Satellite Operations Center now controls the satellite communications system from the command's Point Mugu, California, headquarters via connections to the Air Forces' satellite control network to the Navy.

There are a total of nine UFO satellites in the full constellation, including one on-orbit spare. The communications payloads and their associated satellite are shown below:

Payload	UFO Sats	Chan	Capabilities
UHF	1 – 10	18	25-kHz
	1 – 10	21	5-kHz
EHF	4 – 6	11	LDR
	7 – 10	20	LDR
GBS	8 – 10	4	24-Mbps Ku-band

UFO satellites 5 through 10 have EHF payloads that supplement Milstar capacity. These are called UFO/E payloads. UFO/E launches began in January 1995. UFO satellites 5 and 6 were equipped with UFO/E payloads, and satellites 7 through 10 were equipped with enhanced UFO/E payloads (UFO/EE).

UFO/E Payload: UFO/E is equipped with an earth coverage beam and a 5-degree spot beam antenna. There are seven uplink channels associated with the spot beam and four uplink channels associated with the earth coverage beam. The alignment of these channels is fixed and cannot be changed. Normally, one of the earth coverage uplinks is assigned to the Naval Satellite Operations Center for telemetry and control, but it may be shared with operational users.

FO/EE Payload: The UFO/EE program increased the capabilities of the UFO/E satellites 7 through 10. Communications channels increased from eleven to twenty and acquisition

The mission of the UFO system is to provide UHF links between tactical ground forces, naval aircraft, ships, submarines and their ground stations, and between strategic air headquarters and the National Command Authority network.

The first UFO satellite was launched in March 1993 but after failing to achieve proper orbit, does not function. The second UFO satellite was launched 3 September 1993 and became the first operational spacecraft in the planned nine-satellite constellation.

channels increased from seven to eight. Additionally, the channel groups can be switched between the earth coverage and 5-degree spot beam antennas. The channels are divided into a 20-channel group (16 communications channels and four acquisition channels) and an 8-channel group (four communications channels and four acquisition channels).

UFO satellite 8 is currently operating with a Global Broadcast Service (GBS) package incorporated as part of its communications payload. UFO satellites 9 and 10 are similarly configured with GBS packages. UFO satellites have a mean mission duration/service life of ten years but have enough fuel onboard to last fourteen years.

The FLTSATCOM system has four satellites in geosynchronous orbit, all in a reserve status.

The Fleet Satellite Communications System

The Fleet Satellite Communications (FLTSATCOM) is a UHF/EHF military satellite communications system shared by the Navy, Air Force, Army, and DoD. It is capable of providing reliable, secure communications for ships and submarines at sea, aircraft, and military ground units throughout the world, however its main purpose is for naval afloat communications. FLTSATCOM provides instant worldwide communications between the National Command Authority and Commanders in Chief (CINCs) and warfighters. This constellation is being phased out and replaced with the UHF Follow-On System.

The FLTSATCOM system has four satellites in geosynchronous orbit, all in a reserve status. The system provides worldwide UHF communications service between the latitude of 70 degrees north and 70 degrees south. Each FLTSAT (figure 4-4) has a l6-foot wide parabolic transmitting

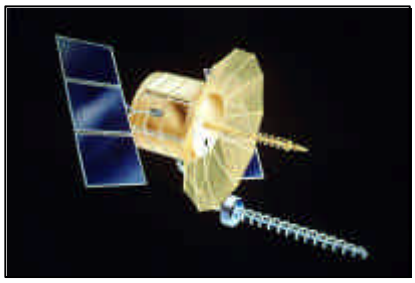


Figure 4-4. FLTSATCOM Satellite

antenna dish in the center of the satellite and a l2.6-foot helix receive antenna. Each FLTSAT provides 22 UHF channels as follows:

- One Super High Freqency (SHF) anti-jam uplink/UHF downlink one-way fleet broadcast 25 kHz access which provides 15 Time Division Multiple Access 100 wpm teletype circuits. This access is different from the others. It receives fleet broadcast at SHF, performs on-board processing, and downlinks at UHF.
- Twelve 5 kHz UHF channels for ship-to-ship, ship-to-shore, shore-to-ship and patrol air craft-to-ship voice or data transmissions.
- Ten 25 kHz UHF accesses.
- One 500 kHz UHF wideband transponder sub-divided into 21 25 kHz channels and capable of 21 simultaneous data accesses or vocoded voice accesses.

The 500 kHz transponder, 12 5 kHz channels, and 10 25 kHz UHF channels are independent of each other. The failure of one does not affect the others. The Navy has applied ground-based Demand Assigned Multiple Access (DAMA) techniques for more efficient channel use. DAMA is covered extensively in annex B.

The FLTSATCOM EHF Package

The FLTSATCOM EHF Package (FEP) is a Milstar-compatible communications package that was placed on the last two FLTSAT UHF

satellites launched. One package, FEP-1, is on FLTSAT-7 over West Continental United States (CONUS), and the other, FEP-2, is on FLTSAT-8 over the Atlantic. The purpose for launching these FEP packages is for testing Milstar communications terminals. The FEP provides approximately 30 communications channels with 5-degree spot beam and earth coverage antennas. This is approximately 1/6 the Low Data Rate (LDR) communications capability of a Milstar satellite. FEP, being a resident on a non-hardened satellite, does not provide the degree of survivability inherent in a Milstar satellite. It does not provide most of the anti-jam capability that a Milstar satellite provides. The FEP package weighs about 250 pounds, but with maturing technology, it can be reduced to l50 pounds. FEP-like packages can clearly support Army Ground Mobile Forces requirements particularly when complemented with Milstar.

Air Force Satellite Communications System

There are no separate Air Force Satellite Communications (AFSATCOM) satellites. Instead, AFSATCOM transponders are "passengers." These transponders are packages that have been added to other satellite systems. The current AFSATCOM system utilizes several satellite programs, providing both geosynchronous coverage (approximately 70 degrees north and south of the equator) and polar coverage, which fills in the area above 70 degrees north. Primary satellite systems in geosynchronous orbit providing two-way UHF communications for AFSATCOM includes FLTSATCOM, and one Lincoln Experimental Satellite (LES). Offering an alternate path for Emergency Action Dissemination (EAM), is a payload on board the Defense Satellite Communications System (DSCS).

There are 12 AFSATCOM 5 kHz channels that are independent of other communications on their host satellites. These channels are processed and do not utilize DAMA technology. Additionally, on the CONUS, Atlantic, and Pacific AFSATCOMs, there is a 500 kHz wideband transponder. The Joint Staff allocates channel capacity. Many of the current high priority uses of AFSATCOM will be transferred to Milstar when that constellation becomes operational.

The AFSATCOM 500 kHz transponder supports users in two ways: the first being connectivity for the Joint Chiefs of Staff/CINC Internets which frequency-hop within the 500 kHz bandwidth (not an anti-jam system; hopping is used to preclude inadvertent interference and selective fading) and the second is accomplished by dividing the transponder into 21 accesses of 25 kHz allowing customers to share the 500 kHz bandwidth (plus an additional 12.5 kHz on each end). No guardbands exist between these 21 channels. Users share the available power. However, the user with the most power can interfere with other users and limits the number of simultaneous accesses.

AFSATCOM is "owned" by the Air Force and is primarily intended for nuclear wartime communications. It is also routinely used by a number of critical non-nuclear users who can claim top priority for its communications suite.

Lincoln Experimental Satellites

LES-8 and LES-9 were built and maintained by the Massachusetts Institute of Technology (MIT)-

There are no separate AFSATCOM satellites. Instead, AFSATCOM transponders are "passengers." These transponders are packages that have been added to other satellite systems.

AFSATCOM is "owned" by the Air Force and is primarily intended for nuclear wartime communications. It is also routinely used by a number of critical non-nuclear users who can claim top priority for its communications suite.

The Advanced MILSATCOM CRD addresses north polar coverage as a threshold Key Performance Parameter (KPP). South polar coverage is listed as an objective KPP.

Current Army satellite single channel ground terminals operate in the UHF frequency band and are available in vehicle and manpack versions.

Lincoln Labs. There is one active satellite, LES-9, remaining in orbit. Both satellites were launched in 1976 and pioneered several new technologies which have been incorporated into systems in use today. These satellites provided information for finding new methods to implement digital and voice circuits among widely separated, fixed, or mobile platforms. The circuits used in these satellites were jam-resistant to allow operations in a threat environment. Today, LES-9 provides additional UHF communications channels and is managed and funded by the AFSATCOM system operational manager. In addition, since its orbit inclines 18 degrees north and south of the equator, versus a goal of 5 degrees or less for other geosynchronous military satellites, the LES-9 satellite provides communications to the Arctic and Antarctic areas for several hours each day. Use of the satellite may require periodic re-pointing of terminal antennas to keep track of these synchronous inclined satellites.

Defense Satellite Communications System

The DSCS satellites are not normally considered to be a part of the single channel/ AFSATCOM system. However, the DSCS III satellites do include a payload that provides an enhanced AFSATCOM function. This payload, called the *Single Channel Transponder (SCT)*, is the space segment of the Single Channel Transponder System (SCTS), providing an alternate method of EAM dissemination and force direction which allows a robust SHF uplink signal and a UHF or SHF downlink signal. SCTS is limited to one-way transmission: to the forces. No report-back capability is offered. Selected ground and airborne terminals can transmit this SHF and/or UHF emergency action or force direction message.

Polar Satellites: Satellite Data System and Package D

There are two programs of classified-host satellites that provide support for AFSATCOM payloads: the Satellite Data System (SDS) and Package D. These satellites provide UHF SATCOM communications for the users in the polar regions where communications using other more equatorial-based satellites are difficult, if not impossible. The SATCOM Management Center receives orbital information for the available polar satellites and then determines appropriate times for the AFSATCOM payloads onboard these satellites to be enabled or disabled. Satellite Data System: SDS satellites include a payload similar to the 12-channel AFSATCOM 5 kHz system onboard the FLTSATs, with the exception that all 12 channels are regenerative and support only 75 bps customers. EAM functions are the same and channels one through seven can frequency hop. There are no non-regenerative channels, 5, 25, or 500 kHz, available on the SDS satellites.

Package D: The Package D satellites provide a UHF package identical to the SDS satellites, with the exception that the first 10 channels can frequency-hop versus the first seven on the FLTSATCOM and SDS satellites. In addition, Package D satellites include an SCT payload similar to that onboard the DSCS-III satellites, and allow an SHF uplink. The Package D SCT does not provide an SHF downlink, however, and transmits only at UHF.

GROUND TERMINAL SEGMENT FOR SINGLE CHANNEL SATCOM

Current Army satellite single channel ground terminals operate in the UHF frequency band and are available in

vehicle and manpack versions. These terminals transmit/receive over the narrowband 5 kHz and 25 kHz channels previously described in the space segment. Their lightness, ready availability, ease of use, and interoperability with Army digital telephones and cryptographic systems make them valuable for mobile and covert operations spanning the spectrum of military missions. The main disadvantages of these terminals is the difficulty in obtaining access to the UHF space segment and the lack of anti-jam capability for threat mitigation. A general overview of each single channel ground receiver is given in the following paragraphs. The specifics and technical data on each terminal can be found in CJCSM 6231.04A, which is accessible via the internet at *www.dtic.mil/doctrine/jel/cjcsd/cjcsm.htm*

AN/PSC-5, Spitfire—DoD's Choice for UHF SATCOM

The AN/PSC-5, also known as the Spitfire, is a multi-service, lightweight UHF satellite terminal that supports single channel communications at all echelons. This terminal is the DoD's choice to replace all UHF manportable and vehicular SATCOM radios, the AN/PSC-3, AN/VSC-7, and all other non-DAMA UHF ground terminals. The Spitfire program was directed to fulfill Joint Staff mandates of narrowband (5-kHz) secure communications capability and DAMA capability by September 1996. Because this terminal is the first to provide DAMA capability for Army users, it is important to have an understanding of the DAMA concept. A thorough explanation of DAMA can be found in Annex B.

The AN/PSC-5 is being fielded now along with the requisite training. The terminal is a non-developmental item manufactured by Magnavox and includes embedded Communications Security (COMSEC), narrowband voice, 5- and 25-kHz DAMA, and Line of Sight (LOS) communications for voice and data. As shown in figure 4-5, the AN/PSC-5 is being fielded as a system complete with handset, line of sight antenna, and 11dBi satellite antenna. Because it is a non-developmental item, the AN/PSC-5 was tested to strict standards set forth in the Statement of Work. A soldier in Mission Oriented Protective Posture Level IV protective clothing or cold weather clothing can operate it. The terminal is submersible in three feet of water and can withstand a drop of four feet. It is decontaminable with soap and water. The AN/PSC-5, when "jump tested" by soldiers in the 82nd Airborne Division, was found to survive the jump if properly wrapped, similar to other commercial-off-the-shelf terminals such as the MST-20+ or the LST-5C.

The Spitfire is a multi-service, lightweight UHF satellite terminal that supports single channel communications at all echelons.

The Spitfire is being fielded now along with the requisite training.

Figure 4-5. AN/PSC-5 (Spitfire) UHF Tactical Ground Terminal

Information on the use and operation of the AN/PSC-5 Spitfire terminal can be found in the TTP manual located at www.gordon.army.mil/tsmts. At this site you can also check out Leader Checklists, Satellite Access Requests, and how to get parts for the AN/PSC-5.

The AN/PSC-5 is owned and operated by the user. The terminal has an initial three-year commercial warranty. After that time, the standard three-level Army maintenance program covers the terminal. (Unit level maintenance, which is very limited, consists of replacing knobs on the front panel, repairing or replacing the battery box, and replacing the radio/transmitter).

Terminal Specifics

The AN/PSC-5, Spitfire, operates in the 30-400 MHz frequency range and provides both voice and data communications. For SATCOM operations (225-400 MHz), the terminal operates on either wideband (25-kHz) or narrowband (5-kHz) channels in the dedicated and DAMA modes. The components of the AN/PSC-5 are the radio receiver/transmitter, battery box, line-of-sight antenna, handset (H-250U), six cables for connection to the SATCOM antenna, input/output devices, and range extension equipment, either with another Spitfire or with SINCGARS. The terminal is issued with a medium gain SATCOM antenna (AS-4326/P) and extension kit (MK-2799/U). The terminal possesses embedded COMSEC to allow the encryption of voice, data, and orderwire transmissions. For voice and data encryption, the embedded COMSEC capabilities include KY-57/58, KG-84, and ANDVT/KYV-5 (compatible with KY-99 and KY-99A). Orderwire transmissions, used in DAMA for control, are encrypted by the terminal via the embedded KGV-11. The AN/PSC-5 also comes with a retransmission capability for extension of SINCGARS nets.

The AN/PSC-5 provides data rates of 75 bps to 16 kbps for baseband data traffic. Voice traffic will be conducted at either 2.4 or 16 kbps, depending upon the type of channel authorization and DAMA configuration of that channel. DAMA orderwire traffic is transmitted at 75 bps. Specific, selectable data rates are as follows for each mode of operation:

Line of Sight (LOS) – 16 kbps
SATCOM: 1200 bps, 2400 bps, 9600 bps, and 16 kbps
DAMA: 75 bps, 300 bps, 600 bps, 1200 bps, 2400 bps, 4800 bps, 9600 bps, 16 kbps

Additional information on the use and operation of the AN/PSC-5 Spitfire terminal can be found in the Tactics, Techniques, and Procedures manual located at www.gordon.army.mil/tsmts. This manual also contains detailed network diagrams, access procedures, configuration codes, channel authorization listings, a leader's checklist, and examples of DAMA satellite access requests. It is a valuable reference for those units receiving Spitfire terminals.

Legacy UHF SATCOM Systems

AN/PSC-3

The AN/PSC-3 is a manportable, militarized, self-contained, battery operated single channel, half duplex UHF SATCOM transceiver. It operates at frequencies between 225-400 MHz. It has four transmit and four receive channels. Accessories include a battery pack, a ll0/220V AC power adapter, a small helical SATCOM antenna for transmission to a UHF satellite, and whip antenna for SATCOM reception while moving, or ground line-of-sight transmission and reception. With all the accessories, the AN/PSC-3 weighs about 28-30 pounds. Without the accessories, it weighs l5 pounds. It was designed to be used by Special Forces, Ranger units, and Infantry units providing them the capability of voice communications at 300, 1200, and 2400 bps over a 5 kHz channel. Turnaround

time of a transmission (receive to transmit/transmit to receive) is 50 msec maximum. A TSEC/KY-57 can be connected to provide a secure voice and data capability.

AN/VSC-7

The AN/VSC-7 is a vehicle mounted version of the AN/PSC-3 with an added applique that permits transmission and reception of selective call signals. It is capable of controlling a net of up to 15 AN/PSC-3 terminals and provides base station capabilities. The Army has approximately 117 AN/VSC-7s in its inventory.

HST-4A/C

The HST-4A is a miniaturized, commercial, lightweight, UHF single-channel data or voice transceiver that operates in the UHF frequency band from 225 to 400 MHz. It features a two card built-in modem to provide 1200 or 2400 bps data capability. The HST-4C has an improved power amplifier with increased output power and greater sensitivity. There are five channels, four of which can be preset and one that is a manual set. Without the battery, the terminal weighs 7 pounds. The HST-4A/C is compatible with the AN/PSC-3, AN/WSC-3, URC-101/110, AN/ARC-171, and the LST-5B/C. It is made by Cincinnati Electronics Corp. There are approximately 130 HST-4A/C terminals in the Army inventory. The terminals are locally purchased and maintained by the unit.

AN/PSC-7 (MST-20+)

The AN/PSC-7 is also known as the MST-20+ (Miniature Satellite Transceiver) and is a product improvement of the HST-4C. It is manportable but not militarized. It is a UHF terminal operating between 225-400 MHz. It has five transmit and five receive channels, all preset. It weighs 7.2 pounds without accessories/battery. It operates at 1200 or 2400 bps data and AM/FM voice at l6 kbps. The AN/PSC-7(MST-20+) was purchased in 1992 by the Army for use in the Corps and Division Warfighter Nets. The Army inventory contains 480 terminals for Warfighter Net use and 277 terminals dedicated for Special Forces, a total of approximately 757 AN/PSC-7s. The AN/PSC-7 is not DAMA-capable and will be replaced by the AN/PSC-5 (Spitfire). The AN/PSC-7 is manufactured by Cincinnati Electronics Corporation and is fielded and fully supported by the Army.

LST-5

The Lightweight Satellite/LOS Terminal (LST-5) is manufactured in several versions. The Army uses the LST-5C and LST-5D versions. At figure 4-6 is the LST-5D. This series of terminals are small, UHF, tactical SATCOM LOS transceivers. The LST-5, with microprocessor control and Erasable Programmable Read

Figure 4-6. The Lightweight Satellite LST-5D/LOS Terminals

The single channel legacy terminals, although not DAMA-capable, are still in use throughout the Army. Until units are fielded with the Spitfire terminal, the use of these radios is authorized.

The SECOMP-I is designed for the use of Corps/Joint Task Force/Army Force commanders and staff while deploying to a theater of operations onboard USAF aircraft or onboard ocean-going transport vessels, or in command party locations on the ground after arriving in theater.

Only Memory is designed for ease of use and reliability. Current applications include portable manpack, vehicular, airborne, shipboard, remote, and fixed station. Four push buttons control all modes of operations, frequencies, bands, and preselects. This terminal can receive and transmit on any two of nine preset channels and scan any two of nine preset channels. The set is compatible with TSEC/KY-57 and other COMSEC devices.

The weight of the LST-5C is approximately 8.4 pounds. The Army version of the LST-5C is known as the AN/PSC-10 and there are about 740 terminals in the inventory. It is logistically supportable by the Army. The LST-5D is DAMA-capable and is now certified for military operations. Potential users should be aware that this terminal operates in 225-400 MHz only. Additional information on the entire series of LST-5 radios can be obtained by contacting Motorola, Inc. via their website *www.motorola.com* (Products and Services).

SECOMP-I

The SECOMP-I is a lightweight, highly compact, communications system. It is designed for the use of Corps/Joint Task Force/Army Forces commanders and staff while deploying to a theater of operations onboard United States Air Force (USAF) aircraft or onboard ocean-going transport vessels, or in command party locations on the ground after arriving in theater. This specialized SECOMP-I equipment package provides long-range, beyond line-of-sight, and line-of-sight UHF single channel tactical satellite and Very High Frequency Command, Control Communications, Computers, and Intelligence secure voice and data communications. It has two laptop PC workstations and one printer for interoperation between computer locations.

The SECOMP-I will provide force projection commanders the capability to maintain communications with higher headquarters, the National Command Authority, and other military forces or subordinate deploying elements who might also be in flight or afloat. The SECOMP-I system is self-contained and can be operated enroute to the area of operations using aircraft power for in-flight operations. It can also be ground mounted in areas that have poor communications infrastructure. While airborne, the SECOMP-I configuration requires the use of hatch-mounted satellite antennas as well as use of aircraft antennas for UHF Amplitude Modulation or Frequency Modulation inter-aircraft communications. A lightweight, portable ground-mounted antenna is also required with each SECOMP-I system.

SECOMP-I comes in two versions: the command and standard versions. The command version will operate in both the secure voice and data modes simultaneously, using both 5-kHz and 25-kHz type channels, and using up to three terminals. Operation can be onboard USAF cargo aircraft, from the decks of transport vessels, or on the ground. The standard version will operate the same but will have only two terminals. SECOMP-I is mounted on a portable wheeled frame (similar to a mover's dolley) or in transit cases. This combat environment survivable unit can be easily moved onto or off of USAF cargo aircraft or transport vessels by one soldier.

As of this printing, SECOMP-I has not been produced, and the program is currently unfunded. Commercial-off-the-shelf versions, however, have been purchased and are being used with

some success by the 82nd Airborne Division and XVIII Airborne Corps. The current distribution plan for the SECOMP-I is shown below. Fielding dates are not set.

Command Version (C)
Standard Version (S)

	(C)	(S)
XVIII Airborne Corps	16	22
V Corps	7	8
I Corps	5	6
75th Ranger Regiment	10	13
USASOC	12	22
25th ID	3	5
175th SIB	1	3

ARMY SINGLE CHANNEL SATCOM VIA MILSTAR

Milstar differs from the UHF constellations in that it will support both single and multichannel communications through different Milstar ground terminals. For the purposes of this chapter, we will only discuss its single channel attributes. Milstar, the newest DoD satellite constellation will provide EHF LDR at up to 2.4 kbps for single channel communications using the SCAMP ground terminal, AN/PSC-11.

The entire Milstar constellation will consist of six satellites. The first two Milstar I satellites have LDR-only capability. The remaining four Milstar II satellites, once launched, will have Medium Data Rate (MDR) EHF capabilities which increases channel capacity to 1.544 Mbps. The LDR portion of the communications payload will be discussed in this section. The MDR portion will be discussed in Chapter 5, Multichannel SATCOM.

Geographic usable coverage by the Milstar space segment is worldwide between 65 degrees south and 65 degrees north (figure 4-7). In this figure, the overlapping coverage shows the range of the current two satellites on orbit now and the projected coverage of the remaining four satellites yet to be launched.

Crosslinks between the Milstar satellites permit worldwide communications without the use of ground stations. This is helpful in a jamming scenario. The Milstar satellites employ the EHF frequency band for the following reasons:

- Narrow antenna beams for low probability of interception and detection, anti-jamming, and spatial diversity.
- Wide bandwidth for anti-jam processing
- Combinations of earth coverage, agile, wide and narrow spot antennas provide appropriate power levels for each type of earth terminal.

Milstar differs from the UHF constellations in that it will support both single and multichannel communications through different Milstar ground terminals.

The Milstar LDR Payload

The Milstar LDR payload supports the single channel communications available using the Milstar I satellite constellation. The Milstar LDR payload is shown as a separate block diagram (figure 4-8) and again, as an integrated package in the overall Milstar communications payload (figure 4-9).

Crosslinks between the Milstar satellites permit worldwide communications without the use of ground stations.

There are nine EHF uplink beams; one earth coverage, one wide spot beam, two narrow spot beams, and five agile beams; there are five downlink beams as shown. The LDR comprises 75 bps, 150 bps, 300 bps, 600 bps, 1.2 kbps, and 2.4 kbps. There is the capability to crossband from EHF to UHF and vice versa. The Milstar payloads provide on-board processing of incoming signals so that addition and subtractions of user terminals does not require power and bandwidth balancing.

The LDR crosslink consists of a classified number of 75 bps crosslinks and 600 bps crosslink slots. If a